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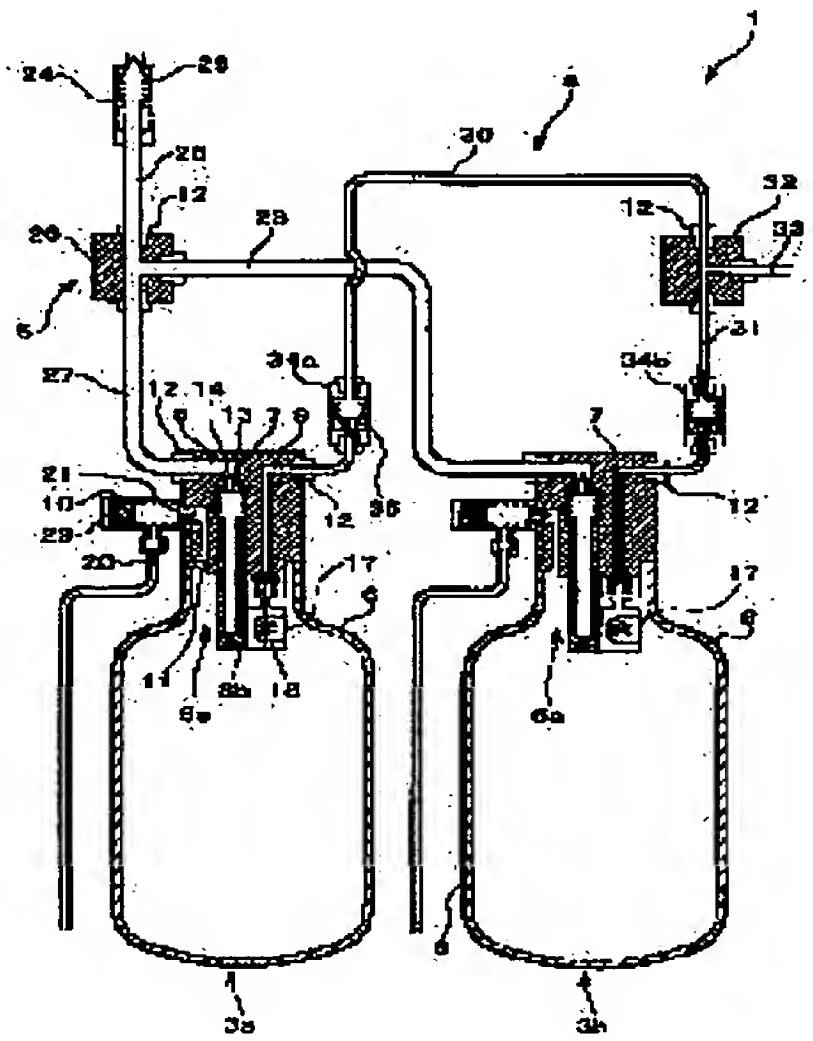
(54) HIGH PRESSURE GAS SUPPLY SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a configuration for preventing backflow of high pressure gas due to internal pressure difference caused among a plurality of high pressure containers.
SOLUTION: This high pressure gas supply system is provided with a supply line 4 for supplying high pressure gas from the high pressure containers 3a, 3b. The supply line 4 has a supply pipe 30 connected to the high pressure container 3a, a supply pipe 31 connected to the high pressure container 3b, and a pipe joining part 32 for joining the supply pipe 30 and the supply pipe 31. The supply pipe 30 is provided with a check valve 34a for establishing a passage when the internal pressure in the high pressure container 3a is higher than the pressure on the pipe joining part 32 side. The supply pipe 31 is provided with a check valve 34b for establishing a passage when the internal pressure in the high pressure container 3b is higher than the pressure on the pipe joining part 32 side.



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CLAIMS

[Claim(s)]
[Claim 1] The supply line for having two or more high pressure vessels which can hold high pressure gas, and supplying said high pressure gas from said high pressure vessel, It is the high pressure gas distribution system equipped with the closing motion valve which controls closing motion of said high pressure vessel. Said supply line The high pressure gas distribution system characterized by having an antisuckback means to prevent that high pressure gas flows backwards to said high pressure vessel from said charging line connected to each of said high pressure vessel, the piping unification section which joins said charging line, and said piping unification section.
[Claim 2] Said antisuckback means is a high pressure gas distribution system according to claim 1 characterized by being the check valve prepared between said piping unification sections and said high pressure vessels or in said high pressure vessel.
[Claim 3] Said antisuckback means is a high pressure gas distribution system according to claim 1 or 2 characterized by being the cross valve prepared in said piping unification section.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the high pressure gas distribution system which supplies the high pressure gas stored in the high pressure vessel to a

fuel cell etc.

[0002]

[Description of the Prior Art] The fuel cell electric vehicle attracts attention from the environmental side of controlling the discharge of the carbon dioxide leading to global warming in recent years. A fuel cell electric vehicle carries the fuel cell which hydrogen and the oxygen in air are made to react electrochemically, and generates them, supplies the electrical and electric equipment which the fuel cell generated to a motor, and is generating driving force. Since the hydrogen used for this fuel cell electric vehicle is easy handling compared with a liquid, the thing of a gaseous condition is used, and the high pressure vessel is used as that storage means. Moreover, although the hydrogen gaseous fuel automobile equipped with the internal combustion engine which burns hydrogen gas instead of a gasoline also attracts attention from the environmental side, since the same is said of this hydrogen gaseous fuel automobile, the high pressure vessel is carried.

[0003] The quality of the material of this high pressure vessel used plastics, such as polyethylene, as the base material from a viewpoint of lightweight-izing, and pressure resistance is secured by reinforcing this with a fiber. Moreover, a high pressure vessel is re-filled up with the hydrogen gas which decreased in number by use from the source of hydrogen gas supply installed in a hydrogen gas station like a gas station. In addition, two or more loading is carried out at one fuel cell electric vehicle, and the high pressure vessel has composition which can be supplied to a fuel cell in hydrogen gas from each high pressure vessel at alternative or coincidence.

[0004] Here, high pressure gas is supplied to a fuel cell etc. from such a high pressure vessel, or invention indicated by JP,8-177641,A is raised as a conventional example of the high pressure gas distribution system which fills up this high pressure vessel with high pressure gas. This high pressure gas distribution system has the high pressure gas distribution system which has the supply line which supplies high pressure gas to a fuel cell etc. from two high pressure vessels, and the charging line which fills up a high pressure vessel with high pressure gas, and has the composition of sharing the principal part of a supply line, and the principal part of a charging line. The configuration of the part mainly near a high pressure vessel has the configuration from which a charging line and a supply line differ, in this part, a charging line has piping equipped with the check valve, and the supply line has piping equipped with the closing motion valve. Furthermore, these piping is arranged at juxtaposition, supply of the high pressure gas to a fuel cell etc. is controlled by closing motion of a closing motion valve from a high pressure vessel, and restoration of the high pressure gas to a high

pressure vessel is controlled by the check valve. This high pressure gas distribution system has prevented that the high pressure gas with which the high pressure vessel was filled up flows backwards to the common area of a supply line and a charging line by the check valve. In addition, since piping equipped with the check valve and piping equipped with the closing motion valve are connected with high pressure gas after they join, the number of openings which a high pressure vessel has is one.

[0005]

[Problem(s) to be Solved by the Invention] However, in such a high pressure gas distribution system, when the internal pressure of one high pressure vessel was high and each closing motion valve was opened in the condition that the internal pressure of the high pressure vessel of another side is remarkable, and low, the high pressure gas in a high pressure vessel with high internal pressure might flow backwards rapidly in the high pressure vessel with low internal pressure through piping and a closing motion valve. Here, when high pressure gas contains many hydrogen gas, within a high pressure vessel with low internal pressure, generation of heat by the adiabatic compression of hydrogen gas and generation of heat by the expansion explained according to the Joule Thomson effect in addition to this mainly occur. Therefore, if high-pressure hydrogen gas flows backwards rapidly to a high pressure vessel with low internal pressure, the temperature in this high pressure vessel will rise rapidly, and will cause the problem of having bad effect on the equipment with which the high pressure vessel itself and the high pressure vessel were equipped. In addition, the temperature change of the gas at the time of a gas carrying out heat insulation irreversible expansion of the Joule Thomson effect is explained, and heat insulation irreversible expansion of hydrogen gas serves as an exoergic process in ordinary temperature. Moreover, when there was an internal pressure difference as mentioned above, even if it closed the closing motion valve of a high pressure vessel with low internal pressure, depending on differential pressure, the check valve may have carried out the same actuation as the time of restoration of high pressure gas, and may have changed into the open condition, and high pressure gas with a high pressure may have flowed backwards in the high pressure vessel with low internal pressure. Therefore, even if the technical problem which this invention tends to solve is the case where differential pressure is among two or more high pressure vessels with which it filled up with the high pressure gas which uses hydrogen gas as a principal component, it is preventing high pressure gas flowing backwards from a high pressure vessel with high internal pressure to a high pressure vessel with low internal pressure, and preventing the unnecessary temperature rise of a high pressure vessel.

[0006]

[Means for Solving the Problem] Invention concerning claim 1 of this invention which solves the aforementioned technical problem The supply line for having two or more high pressure vessels which can hold high pressure gas, and supplying high pressure gas from a high pressure vessel, It is the high pressure gas distribution system equipped with the closing motion valve which controls closing motion of a high pressure vessel. A supply line It considered as the configuration equipped with an antisuckback means to prevent that high pressure gas flows backwards to a high pressure vessel, from the charging line connected to each of a high pressure vessel, the piping unification section which joins a charging line, and the piping unification section.

[0007] The high pressure gas distribution system which has such a configuration becomes able [the high pressure gas supplied from each high pressure vessel flow only in the specific direction] to make it by establishing an antisuckback means. therefore -- for example, even if differential pressure is between the high pressure gas which two or more high pressure vessels are alike, respectively, and is held, high pressure gas with a high pressure should pass the piping unification section -- it can prevent certainly flowing backwards to a high pressure vessel with low internal pressure.

[0008] Moreover, invention concerning claim 2 of this invention used the antisuckback means as the check valve prepared between the piping unification section and high pressure vessels or in a high pressure vessel in the high pressure gas distribution system according to claim 1. A check valve can make the flow of the high pressure gas which is going to flow backwards a supply line certainly stop by preparing a check valve between the piping unification section and a high pressure vessel, since it has the configuration which passes the gas of only an one direction, even when differential pressure is in the high pressure gas in each high pressure vessel. Moreover, the same operation is done so even if it forms in the plug of a high pressure vessel etc., without preparing this check valve into piping.

[0009] Furthermore, invention concerning claim 3 of this invention used the antisuckback means as the cross valve prepared in the piping unification section in the high pressure gas distribution system according to claim 1 or 2. Since a cross valve has three ports which can connect piping and has the configuration which chooses one port from the two remaining ports, and is made to open for free passage to the specific port If a cross valve is prepared in the piping unification section, for example, piping of one can be chosen from piping of two connected to two high

pressure vessels in two or more high pressure vessels, and it can be made open for free passage with the one remaining piping. Therefore, since piping of the direction which was not chosen will be separated from the flow of high pressure gas, high pressure gas does not flow backwards for piping of the direction which was not chosen. In addition, by combining such a cross valve suitably, even if it is two or more high pressure vessels, it becomes possible to choose Rhine which supplies high pressure gas.

[0010]

[Embodiment of the Invention] The gestalt of operation of this invention is explained to a detail using a drawing. the schematic diagram of the fuel cell electric vehicle with which drawing 1 carried the high pressure gas distribution system in the gestalt of this operation -- it is -- drawing 2 -- the block diagram of a high pressure gas distribution system, and drawing 3 -- some high pressure vessels -- it is an enlarged drawing. As shown in drawing 1 , the high pressure gas distribution system 1 is carried in the fuel cell electric vehicle (henceforth an automobile) equipped with the fuel cell 2, equipped juxtaposition with two high pressure vessels 3a and 3b which can be filled up with high pressure gas, and is equipped with the supply line 4 for supplying high pressure gas to a fuel cell 2 from each high pressure vessels 3a and 3b, and the charging line 5 for filling up these high pressure vessels 3a and 3b with high pressure gas. In addition, in the gestalt of this operation, high pressure gas means gas with many contents of hydrogen gas and hydrogen gas, and natural gas (CNG:Compressed Natural Gas) is also contained. Moreover, a fuel cell 2 is generated using the electrochemical reaction of the hydrogen supplied from high pressure vessels 3a and 3b, and the oxygen in the air extracted from the open air, and the motor which is not illustrated is rotated. Moreover, it is also possible to carry the internal combustion engine which burns hydrogen gas and natural gas instead of a fuel cell 2.

[0011] Next, it explains, referring to drawing 2 and drawing 3 about each component of this high pressure gas distribution system 1. In addition, drawing 2 is an enlarged drawing a part and drawing 3 is drawing having shown the condition that high pressure vessel 3a supplied high pressure gas. As shown in drawing 2 , the high pressure gas distribution system 1 has two high pressure vessels 3a and 3b, the charging line 5 for filling each of high pressure vessels 3a and 3b up with high pressure gas, and the supply line 4 for supplying high pressure gas to a fuel cell 2 from each of high pressure vessels 3a and 3b. Moreover, the pressure gage which is not illustrated is formed in the supply line 4, and it is acting as the monitor of the capacity which the pressure of the high pressure gas supplied to a fuel cell 2, i.e., each of high pressure vessels 3a

and 3b, holds. In addition, a pressure gage can also be formed in the part near the high pressure vessels 3a and 3b of a supply line 4, and may be formed in a charging line 5.

[0012] High pressure vessels 3a and 3b have the same configuration, and have the body section 6 which carries out long duration hold of the high pressure gas, and the plug 7 which seals opening 6a prepared in the body section 6. Although these high pressure vessels 3a and 3b can be manufactured from metallic materials, such as steel, its so-called FRP (Fiber Reinforced Plastic) which reinforced plastics, such as polyethylene, with the fiber from a viewpoint of lightweight-izing is desirable. Moreover, the volume and filling pressure of high pressure vessels 3a and 3b can be set up for every automobile. Furthermore, although two high pressure vessels 3a and 3b are shown in drawing 2 , three or more are sufficient.

[0013] As shown in drawing 2 and drawing 3 , the plug 7 has the open hole 11 for equipping with the relief valve 10 which opens the pressure in a high pressure vessel 3 to atmospheric air, when the restoration hole 8 for filling up high pressure vessels 3a and 3b with high pressure gas, the supply hole 9 for taking out high pressure gas from high pressure vessels 3a and 3b, and the temperature of a high pressure vessel 3 rise beyond a predetermined value. The restoration hole 8 is a hole which penetrates a plug 7, as the interior of high pressure vessels 3a and 3b and the outside of high pressure vessels 3a and 3b are opened for free passage, a joint 12 connects with a charging line 5, and, as for the other end side of the restoration hole 8, restoration pipe 8b is inserted by the end side (outside) of the restoration hole 8. Restoration pipe 8b is prolonged inside high pressure vessels 3a and 3b from the restoration hole 8, and has the configuration in which the diameter of opening at the tip decreases. Moreover, the check valve 13 is formed in the opening which the restoration hole 8 and restoration pipe 8b form, and it has prevented that the high pressure gas in high pressure vessel 3a and 3b flows backwards to a charging line 5.

[0014] In addition, as shown in drawing 3 , the check valve 13 has the configuration by which a valve element 14 is energized towards level difference section 8a of the restoration hole 8 with a spring 15 from the interior side of a high pressure vessel 3. Therefore, if the high pressure gas in a charging line 5 becomes large rather than the high pressure gas in high pressure vessel 3a only in a predetermined pressure, a valve element 14 will move to the drawing 3 bottom, and high pressure gas will flow in high pressure vessel 3a and 3b from a charging line 5 side. On the other hand, when the difference of the pressure by the side of a charging line 5 and the pressure in high pressure vessel 3a is smaller than the force in which a spring 15 energizes a valve element 14, since a valve element 14 does not move contacting level difference

section 8a of the restoration hole 8, high pressure gas does not flow. It shall have other configurations and operations with the same said of a check valve henceforth.

[0015] Moreover, the supply hole 9 is a hole formed in the plug 7, as the interior of high pressure vessels 3a and 3b and the outside of high pressure vessels 3a and 3b are opened for free passage, and it is connected to the supply line 4 by the joint 12 in the edge of the outside of the supply hole 9. moreover, the electromagnetism which is a closing motion valve in the lower limit inside the high pressure vessels 3a and 3b of the supply hole 9 -- the latching valve 17 is formed. electromagnetism -- a latching valve 17 opens and closes the supply hole 9 by moving a valve element 19 in the vertical direction of drawing 2 with a solenoid coil 18. in addition, electromagnetism -- the location in which a latching valve 17 is formed -- the outside of a plug 7, and a supply line 4 -- on the way -- it can be alike and can also prepare. moreover, electromagnetism -- although a latching valve 17 can be used as other well-known latching valves, the so-called normally closed (normal close) mold is desirable so that supply of high pressure gas can be suspended at the time of un-working.

[0016] Furthermore, the relief valve 10 is formed in the outside, and, as for the open hole 11, the relief valve 10 is equipped with the piping 20 for disconnection. In drawing 3 , the relief valve 10 has the configuration which energizes a valve element 21 with a spring 22 towards the inside of high pressure vessels 3a and 3b, and the meltable metal 23 is arranged by the other end side of a spring 22. Here, since the meltable metal 23 has the low melting point compared with other members, when the temperature of high pressure vessels 3a and 3b becomes an elevated temperature, the meltable metal 23 melts first. Therefore, in connection with the meltable metal 23 melting, a valve element 21 is pushed on high pressure gas, and high pressure gas is emitted to atmospheric air from the piping 20 for disconnection. Therefore, it can prevent that the internal pressure of the high pressure vessels 3a and 3b by the temperature rise turns into high pressure beyond a predetermined value.

[0017] Next, the charging line 5 and supply line 4 of the high pressure gas distribution system 1 are explained. As shown in drawing 2 , the charging line 5 had the restoration piping 25 connected to the connection 24 for connecting with the source of supply which is not illustrated, and the connection 24, and the restoration piping 25 has branched in the piping tee 26 for the restoration piping 27 and 28 connected to each of high pressure vessels 3a and 3b. In addition, the connection 24 has the check valve 29 for preventing that the open air etc. goes into a charging line 5. Moreover, the supply line 4 has the piping unification section 32 which makes the charging lines 30 and 31 connected to each supply hole 9 of each high pressure vessels 3a and 3b, and

these two charging lines 30 and 31 join, and the supply line 4 after joining is connected to the fuel cell 2 of drawing 1 by the charging line 33. In addition, check valve 34a which is an antisuckback means is prepared in the charging line 30 before unification. This check valve 34a is arranged at the sense to which high pressure gas flows a charging line 30, only when the internal pressure of high pressure vessel 3a is higher than the pressure by the side of the piping unification section 32. Moreover, check valve 34b which is an antisuckback means is similarly prepared in the charging line 31. This check valve 34b is arranged at the sense to which high pressure gas flows a charging line 31, only when the internal pressure of high pressure vessel 3b is higher than the pressure by the side of the piping unification section 32. Therefore, it can prevent that high pressure gas flows backwards inside high pressure vessels 3a and 3b from the piping unification section 32 by these check valves 34a and 34b.

[0018] Next, the procedure filled up with high pressure gas using this high pressure gas distribution system 1 is explained. When the internal pressure of one of the high pressure vessels 3a and 3b or both becomes below a predetermined pressure value, since an alarm lamp lights up to the instrument panel of an automobile etc., an operator performs re-restoration of high pressure gas to high pressure vessels 3a and 3b at a high pressure gas supply station. In this case, the source of supply of a high pressure gas supply station and the connection 24 of the high pressure gas distribution system 1 are first connected by the well-known approach. And the bulb for supply by the side of a source of supply is opened wide, and high pressure gas is introduced into the charging line 5 of the high pressure gas distribution system 1. At this time, the pressure by the side of a source of supply is sufficiently high (former ** of a source of supply 50 MPa(s)) one compared with high pressure vessels 3a and 3b, and the check valve 13 in the plug 7 of high pressure vessels 3a and 3b is pushed towards the inside of high pressure vessels 3a and 3b. [as opposed to / For example, the target filling pressure of high pressure vessels 3a and 3b 25 / MPa(s)] Therefore, the restoration hole 8 of a plug 7 is open for free passage, high pressure gas flows in high pressure vessel 3a and 3b from a charging line 5, respectively, and re-restoration of high pressure gas is started.

[0019] If the pressure in high pressure vessel 3a and 3b becomes a predetermined value (for example, 25MPa), since the difference of the internal pressure of high pressure vessels 3a and 3b and the pressure by the side of a source of supply will become small, the valve element 14 of a check valve 13 is put back with a spring 15, and the restoration hole 8 is closed by the valve element 14. And discharge of connection of a source of supply and the high pressure gas distribution system 1

terminates re-restoration of the high pressure gas to high pressure vessels 3a and 3b. At this time, the pressure in high pressure vessel 3a and 3b is maintained by the check valve 13 in a plug 7. In addition, it fills up with high pressure gas when each internal pressure of the high pressure vessels 3a and 3b before restoration differs, for example, until each internal pressure of high pressure vessel 3a and high pressure vessel 3b becomes a predetermined value (for example, 25MPa(s)) since actuation of the check valve 13 in each plug 7 has the independent internal pressure of high pressure vessel 3a even if the internal pressure of 15MPa(s) and high pressure vessel 3b is 10MPa(s).

[0020] Furthermore, the case where high pressure gas is supplied to a fuel cell 2 is explained from the high pressure vessels 3a and 3b with which it filled up with high pressure gas in this way. the signal from the control unit which is not illustrated when supplying high pressure gas only from high pressure vessel 3a -- winning popularity -- the electromagnetism of high pressure vessel 3a -- only a latching valve 18 is changed into an open condition. Then, since the pressure by the side of the piping unification section 32 of a supply line 4 is low enough compared with the internal pressure of high pressure vessel 3a, the valve element 35 of check valve 34a of a charging line 30 is pushed by the high pressure gas supplied from the high pressure vessel 3, and since it is pushed up to the location shown in drawing 3 from the location shown in drawing 2 , passage is established in check valve 34a. Therefore, the high pressure gas in a high pressure vessel 3 flows in the direction shown in the arrow head of drawing 3 , and is further supplied to a fuel cell 2 through the piping unification section 32 and the charging line 33 which are shown in drawing 2 . Although high pressure gas flows also in a charging line 31 from the piping unification section 32 at this time, since check valve 34b of a charging line 31 does not establish passage even if the piping unification section 32 side becomes high pressure, the high pressure gas supplied from high pressure vessel 3a does not flow backwards to high pressure vessel 3b.

[0021] On the other hand, it is the same as that of the above also about the case where high pressure gas is supplied only from high pressure vessel 3b, and can prevent that the high pressure gas supplied by check valve 34a from high pressure vessel 3b flows backwards to high pressure vessel 3a. Since this means that the check valves 34a and 34b of the high pressure vessels 3a and 3b of the one where internal pressure is always higher will be in an open condition, and the check valves 34a and 34b of the high pressure vessels 3a and 3b of the one where internal pressure is lower will be in a closed state each electromagnetism of both high pressure vessels

3a and 3b -- even if it opens a latching valve 17 wide to coincidence, the high pressure gas from the high pressure vessels 3a and 3b of another side does not flow backwards to one of the high pressure vessels 3a and 3b Moreover, when the internal pressure of high pressure vessel 3a and high pressure vessel 3b is comparable, both check valves 34a and 34b may be in an open condition at coincidence, but since internal pressure is comparable in this case and the back flow of high pressure gas hardly occurs, a problem is not produced.

[0022] If such a high pressure gas distribution system 1 is used, even if differential pressure is between two high pressure vessels 3a and 3b at the time of restoration of high pressure gas, or supply, it can prevent that high pressure gas flows backwards through a supply line 4 to the high pressure vessels 3a and 3b with low internal pressure from the high pressure vessels 3a and 3b with high internal pressure. Therefore, it can prevent that a high pressure vessel 3 becomes an elevated temperature by the exothermic phenomenon by the rapid back flow of high pressure gas. In addition, although check valves 34a and 34b were formed into a charging line 30 and 31 in drawing 2 and drawing 3 , respectively, it is also possible to embed to each plug 7 of high pressure vessels 3a and 3b.

[0023] Next, the gestalt of another operation of the high pressure gas distribution system of this invention is explained using drawing 4 . In addition, the sign same about the same component as drawing 2 is attached, and the explanation is omitted. As shown in drawing 4 , the high pressure gas distribution system 41 has two high pressure vessels 3a and 3b, the charging line 5 for filling each of high pressure vessels 3a and 3b up with high pressure gas, and the supply line 4 for supplying high pressure gas to a fuel cell 2 from each of high pressure vessels 3a and 3b. Moreover, the pressure gage which is not illustrated for the high pressure gas distribution system 41 to act as the monitor of the pressure of high pressure gas is formed like the aforementioned example.

[0024] Here, the supply line 4 has two charging lines 30 and 31 connected to the supply hole 9 of each high pressure vessels 3a and 3b, and the charging line 32 which supplies high pressure gas to a fuel cell 2, and equips the piping unification section of charging lines 30, 31, and 32 with the cross valve 42 for making a charging line 33 open one of the charging lines 30 and 31 for free passage. A cross valve 42 is having port 42b by which the charging line's 31 was connected with port 42a to which the charging line's 30 was connected, and the port 43 where the charging line's 33 was connected, and moving a valve element with an actuator 44 here. It has the structure which can choose port 42a (charging line 30), connection of a port 43 (charging line 33), and

connection between port 42b (charging line 31) and a port 43 (charging line 33), and can be established.

[0025] Such a high pressure gas distribution system 41 serves as the configuration that only one of the high pressure vessels 3a and 3b supply high pressure gas to a fuel cell 2, by the change of a cross valve 42. Therefore, since a charging line 31 will be separated from these charging lines 30 and 33 when a charging line 30 and a charging line 33 are connected by the change of a cross valve 42 and high pressure gas does not flow to a charging line 31, the back flow of high pressure gas does not take place. Since similarly a charging line 30 will be separated from these charging lines 31 and 33 when a charging line 31 and a charging line 33 are connected by the change of a cross valve 42 and high pressure gas does not flow to a charging line 30, the back flow of high pressure gas does not take place. Therefore, in here, a cross valve 42 constitutes the antisuckback means of a publication in a claim.

[0026] In addition, this invention can be applied widely, without being limited to the gestalt of each aforementioned operation. For example, an antisuckback means may consist of check valves 34a and 34b prepared in each of the charging lines 30 and 31 shown in drawing 2 , and a cross valve 42 shown in drawing 3 . moreover, an antisuckback means -- between the piping unification section 32 of drawing 2 , and charging lines 30, and between the piping unification sections 32 and 31 -- respectively -- alike -- electromagnetism -- a latching valve -- preparing -- this electromagnetism -- it is good also as a configuration which chooses the high pressure vessels 3a and 3b which supply high pressure gas by changing closing motion of a latching valve. Furthermore, in the high pressure gas distribution system 41, it can respond also to the high pressure gas distribution system equipped with three or more high pressure vessel 3a by combining two or more cross valves 42 with a serial and juxtaposition. And as for the high pressure gas distribution systems 1 and 41, it is desirable to have a reducing valve for adjusting the pressure of the high pressure gas supplied to a fuel cell 2. Although preparing in a charging line 33 is desirable as for a reducing valve, it may be prepared in every each high pressure vessel 3a and 3b.

[0027]

[Effect of the Invention] In the high pressure gas distribution system which has the configuration whose this invention can supply high pressure gas from each of two or more high pressure vessels Since the high pressure gas which forms an antisuckback means to prevent the back flow of high pressure gas in a supply line, and is supplied from each high pressure vessel considered as the configuration which flows only in the specific direction Even if differential pressure is between the high pressure gas

held in each of two or more high pressure vessels, it can prevent certainly that high pressure gas with a high pressure flows backwards to a high pressure vessel with low internal pressure. Therefore, it can prevent that the temperature of high pressure gas and a high pressure vessel rises abruptly because the high pressure gas which is mainly concerned with hydrogen gas to a high pressure vessel with low internal pressure at the time of supply of high pressure gas flows backwards. If it is the check valve in which the antisuckback means was especially formed between the piping unification section and a high pressure vessel, the flow of the high pressure gas which is going to flow backwards a supply line can be made to certainly stop. Moreover, since an antisuckback means will become possible [choosing Rhine where high pressure gas flows, and Rhine separated from the Rhine] if it is used as the cross valve prepared in the piping unification section, it can prevent that high pressure gas flows backwards to Rhine of the direction which was not chosen.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the schematic diagram showing the fuel cell electric vehicle with which the high pressure gas distribution system of the gestalt of operation of this invention is carried.

[Drawing 2] It is the block diagram of the high pressure gas distribution system of a gestalt at operation of this invention.

[Drawing 3] It is the enlarged drawing showing the configuration of the plug of a high pressure vessel.

[Drawing 4] It is the block diagram of the high pressure gas distribution system in which the gestalt of another operation of this invention is shown.

[Description of Notations]

1 High Pressure Gas Distribution System

2 Fuel Cell

3a, 3b High pressure vessel

4 Supply Line

5 Charging Line

7 Plug

8 Restoration Hole

9 Supply Hole

10 Relief Valve

11 Open Hole

13 29 Check valve

17 Electromagnetism -- Latching Valve (Closing Motion Valve)

30, 31, 33 Charging line

32 Piping Unification Section

34a, 34b Check valve (antisuckback means)

42 Cross Valve (Antisuckback Means)

[Translation done.]

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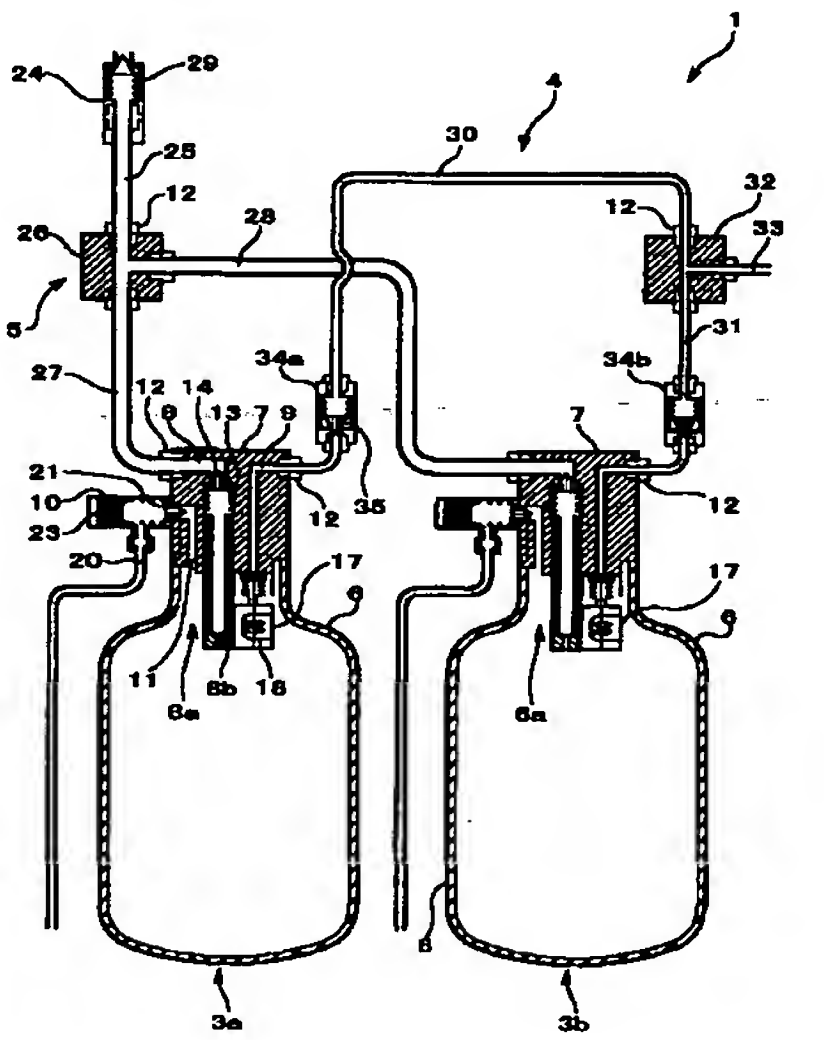
最終頁に続く

(54)【発明の名称】　高圧ガス供給システム

(57)【要約】
【課題】　複数の高圧容器の間に生じた内圧差に起因する高圧ガスの逆流を防止する構成を提供する。
【解決手段】　高圧容器３ａ，３ｂから高圧ガスを供給する供給ライン４を備え、供給ライン４は、高圧容器３ａに接続された供給配管３０と、高圧容器３ｂに接続された供給配管３１と、供給配管３０および供給配管３１を合流する配管合流部３２を有し、供給配管３０に高圧容器３ａの内圧が配管合流部３２側の圧力よりも高い場合に流路を確立する逆止弁３４ａを設け、供給配管３１に高圧容器３ｂの内圧が配管合流部３２側の圧力よりも高い場合に流路を確立する逆止弁３４ｂを設けた。



【特許請求の範囲】
【請求項１】　高圧ガスを収容可能な高圧容器を複数有し、前記高圧容器から前記高圧ガスを供給するための供給ラインと、前記高圧容器の開閉を制御する開閉弁を備えた高圧ガス供給システムであって、
前記供給ラインは、前記高圧容器のそれぞれに接続された前記供給配管と、前記供給配管を合流する配管合流部と、前記配管合流部から前記高圧容器に高圧ガスが逆流することを防止する逆流防止手段を備えたことを特徴とする高圧ガス供給システム。
【請求項２】　前記逆流防止手段は、前記配管合流部と前記高圧容器の間、または、前記高圧容器に設けられた逆止弁であることを特徴とする請求項１に記載の高圧ガス供給システム。
【請求項３】　前記逆流防止手段は、前記配管合流部に設けられた三方弁であることを特徴とする請求項１または２に記載の高圧ガス供給システム。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、高圧容器に貯蔵した高圧ガスを燃料電池等に供給する高圧ガス供給システムに関する。
【０００２】
【従来の技術】近年、地球温暖化の原因になる二酸化炭素の排出量を抑制するなどの環境面から、燃料電池電気自動車が注目されている。燃料電池電気自動車は、水素と空気中の酸素を電気化学的に反応させて発電する燃料電池を搭載し、燃料電池が発電した電気をモータに供給して駆動力を発生させている。この燃料電池電気自動車に用いられる水素は、液体に比べて取り扱いが容易であることから気体の状態のものが用いられ、その貯蔵手段としては高圧容器が用いられている。また、ガソリンの代わりに水素ガスを燃焼させる内燃機関を備えた水素ガス自動車も環境面から注目されているが、この水素ガス自動車も同様の理由から高圧容器を搭載している。
【０００３】この高圧容器の材質は、軽量化の観点からポリエチレン等のプラスチックを母材とし、これをファイバで補強することで耐圧力を確保している。また、使用により減少した水素ガスは、例えば、ガソリンスタンドのような水素ガスステーションに設置された水素ガス供給源から高圧容器に再充填される。なお、高圧容器は一台の燃料電池電気自動車に複数搭載され、各高圧容器から択一に、または、同時に水素ガスを燃料電池に供給可能な構成となっている。
【０００４】ここで、このような高圧容器から燃料電池等に高圧ガスを供給したり、この高圧容器に高圧ガスを充填する高圧ガス供給システムの従来例としては、特開平８－１７７６４１号公報に記載された発明があげられる。この高圧ガス供給システムは、二つの高圧容器から燃料電池等に高圧ガスを供給する供給ラインと、高圧容器に高圧ガスを充填する充填ラインとを有する高圧ガス供給システムを有し、供給ラインの主要部と充填ラインの主要部を共有する構成となっている。充填ラインと供給ラインが異なる構成を有するのは、主に高圧容器に近い部分の構成であり、この部分において充填ラインは、逆止弁を備えた配管を有し、供給ラインは、開閉弁を備えた配管を有している。さらに、これらの配管は並列に配置され、高圧容器から燃料電池等への高圧ガスの供給は、開閉弁の開閉により制御され、高圧容器への高圧ガスの充填は、逆止弁により制御される。この高圧ガス供給システムは、逆止弁により、高圧容器に充填された高圧ガスが供給ラインと充填ラインの共有部分に逆流することを防止している。なお、逆止弁を備えた配管と、開閉弁を備えた配管は、合流した後に高圧ガスと接続されているので、高圧容器が有する開口部はひとつだけである。

【０００５】
【発明が解決しようとする課題】しかしながら、このような高圧ガス供給システムにおいて、一方の高圧容器の内圧が高く、他方の高圧容器の内圧が著しく低い状態で、それぞれの開閉弁を開放すると、内圧の高い高圧容器内の高圧ガスが、配管および開閉弁を通って内圧の低い高圧容器内に急激に逆流してしまうことがあった。ここで、高圧ガスが水素ガスを多く含んでいた場合には、内圧の低い高圧容器内では、主に水素ガスの断熱圧縮による発熱と、その他、ジュールトムソン効果で説明される膨張による発熱が起きる。よって、内圧の低い高圧容器に高圧の水素ガスが急激に逆流すると、この高圧容器内の温度が急激に上昇してしまい、高圧容器自体や高圧容器に備えられた機器類などに悪い影響を与えるという問題を引き起こす。なお、ジュールトムソン効果とは、気体が断熱不可逆膨張する際の気体の温度変化を説明するものであり、水素ガスの断熱不可逆膨張は、常温においては発熱過程となる。また、前記のように内圧差がある場合に、内圧の低い高圧容器の開閉弁を閉じたとしても、圧力差によっては、逆止弁が高圧ガスの充填時と同様の動作をして、開状態になり、内圧の低い高圧容器内に圧力の高い高圧ガスが逆流する可能性があった。従って、本発明が解決しようとする課題は、水素ガスを主成分とする高圧ガスが充填された複数の高圧容器の間に圧力差がある場合であっても、内圧の高い高圧容器から内圧の低い高圧容器に高圧ガスが逆流することを防止し、高圧容器の不必要な温度上昇を防止することである。
【０００６】
【課題を解決するための手段】前記の課題を解決する本発明の請求項１に係る発明は、高圧ガスを収容可能な高圧容器を複数有し、高圧容器から高圧ガスを供給するための供給ラインと、高圧容器の開閉を制御する開閉弁を備えた高圧ガス供給システムであって、供給ラインは、高圧容器のそれぞれに接続された供給配管と、供給配管

を合流する配管合流部と、配管合流部から高圧容器に高圧ガスが逆流することを防止する逆流防止手段を備えた構成とした。

【０００７】このような構成を有する高圧ガス供給システムは、逆流防止手段を設けることで、各高圧容器から供給される高圧ガスが特定の方向にのみ流れるようにすることが可能となる。したがって、例えば、複数の高圧容器のそれぞれに収容されている高圧ガスの間に圧力差があっても、圧力の高い高圧ガスが、配管合流部を経て、内圧の低い高圧容器に逆流することを確実に防止できる。

【０００８】また、本発明の請求項２に係る発明は、請求項１に記載の高圧ガス供給システムにおいて、逆流防止手段は、配管合流部と高圧容器の間、または、高圧容器に設けられた逆止弁とした。逆止弁は、一方向のみのガスを流す構成を有しているので、配管合流部と高圧容器の間に逆止弁を設けることで、各高圧容器内の高圧ガスに圧力差があった場合でも、供給ラインを逆流しようとする高圧ガスの流れを確実にストップさせることができる。また、この逆止弁を配管中に設けずに高圧容器のプラグ等に形成しても同様の作用を奏する。

【０００９】さらに、本発明の請求項３に係る発明は、請求項１または請求項２に記載の高圧ガス供給システムにおいて、逆流防止手段は、配管合流部に設けられた三方弁とした。三方弁は、配管を接続可能な３つのポートを有し、特定のポートに対して、残りの二つのポートから一つのポートを選択して連通させる構成を有しているので、配管合流部に三方弁を設けると、例えば、複数の高圧容器のうちの二つの高圧容器に接続された二本の配管から一本の配管を選択して、残りの一つの配管と連通させることができる。従って、選択されなかった方の配管は高圧ガスの流れから切り離されることになるので、選択されなかった方の配管に高圧ガスが逆流することはない。なお、このような三方弁を適宜組み合わせることで、二つ以上の高圧容器であっても高圧ガスを供給するラインを選択することが可能となる。

【００１０】

【発明の実施の形態】本発明の実施の形態を図面を用いて詳細に説明する。図１は本実施の形態における高圧ガス供給システムを搭載した燃料電池電気自動車の概略図であり、図２は高圧ガス供給システムの構成図、図３は高圧容器の一部拡大図である。図１に示すように、高圧ガス供給システム１は、燃料電池２を備えた燃料電池電気自動車（以下、自動車という）に搭載されており、高圧ガスを充填可能な二本の高圧容器３ａ、３ｂを並列に備え、各高圧容器３ａ，３ｂから燃料電池２に高圧ガスを供給するための供給ライン４と、この高圧容器３ａ，３ｂに高圧ガスを充填するための充填ライン５とを備えている。なお、本実施の形態において、高圧ガスとは、水素ガスおよび水素ガスの含有量が多いガスをいい、天然ガス（ＣＮＧ：Compressed Natural Gas）も含まれる。また、燃料電池２は、高圧容器３ａ，３ｂから供給された水素と、外気から抽出した空気中の酸素の電気化学反応を利用して発電し、図示しないモータを回転させるものである。また、燃料電池２の替わりに水素ガスや天然ガスを燃焼させる内燃機関を搭載することも可能である。

【００１１】次に、この高圧ガス供給システム１の各構成要素について図２および図３を参照しながら説明する。なお、図３は、図２の一部拡大図であり、高圧容器３ａが高圧ガスを供給している状態を示した図である。図２に示すように、高圧ガス供給システム１は、二つの高圧容器３ａ，３ｂと、高圧容器３ａ，３ｂのそれぞれに高圧ガスを充填するための充填ライン５と、高圧容器３ａ，３ｂのそれぞれから高圧ガスを燃料電池２に供給するための供給ライン４とを有している。また、供給ライン４には図示しない圧力計が設けられており、燃料電池２に供給される高圧ガスの圧力、つまり、高圧容器３ａ，３ｂのそれぞれが保有しているガス量をモニターしている。なお、圧力計は、供給ライン４の高圧容器３ａ，３ｂに近い部分に設けることもできるし、充填ライン５に設けても良い。

【００１２】高圧容器３ａ，３ｂは、同じ構成を有しており、高圧ガスを長時間収容する本体部６と、本体部６に設けられた開口６ａを密閉するプラグ７とを有している。この高圧容器３ａ，３ｂは、鉄鋼等の金属材料から製造することができるが、軽量化の観点からは、ポリエチレン等のプラスチックをファイバで補強した、いわゆるＦＲＰ（Fiber Reinforced Plastic）が好ましい。また、高圧容器３ａ，３ｂの容積および充填圧力は自動車ごとに設定することが可能である。さらに、図２には高圧容器３ａ，３ｂは二本示されているが、三本以上でも良い。

【００１３】図２および図３に示すように、プラグ７は、高圧ガスを高圧容器３ａ，３ｂに充填するための充填穴８と、高圧容器３ａ，３ｂから高圧ガスを取り出すための供給穴９と、高圧容器３の温度が所定値以上に上昇した場合に、高圧容器３内の圧力を大気に開放する安全弁１０を装着するための開放穴１１とを有している。充填穴８は、高圧容器３ａ，３ｂの内部と高圧容器３ａ，３ｂの外側を連通するようにプラグ７を貫通する穴であり、充填穴８の一端側（外側）は継手１２により充填ライン５に接続され、充填穴８の他端側は充填パイプ８ｂが挿入されている。充填パイプ８ｂは、充填穴８から高圧容器３ａ，３ｂの内側に延び、その先端の開口径が減少する構成を有している。また、充填穴８と充填パイプ８ｂとが形成する空隙には、逆止弁１３が形成されており、高圧容器３ａ，３ｂ内の高圧ガスが充填ライン５に逆流することを防止している。

【００１４】なお、図３に示すように、逆止弁１３は、

弁体１４が高圧容器３の内部側からバネ１５で充填穴８の段差部８ａに向けて付勢される構成を有している。従って、充填ライン５内の高圧ガスが、高圧容器３ａ内の高圧ガスよりも所定圧力だけ大きくなると、弁体１４が図３の下側に移動し、高圧ガスが充填ライン５側から高圧容器３ａ，３ｂ内に流れる。一方、バネ１５が弁体１４を付勢する力よりも充填ライン５側の圧力と高圧容器３ａ内の圧力の差が小さい場合は、弁体１４は、充填穴８の段差部８ａに当接したまま動かないので、高圧ガスは流れない。以降において、他の逆止弁も同様の構成および作用を有するものとする。

【００１５】また、供給穴９は、高圧容器３ａ，３ｂの内部と、高圧容器３ａ，３ｂの外側を連通するようにプラグ７に形成された穴であり、供給穴９の外側の端部において継手１２により供給ライン４に接続されている。また、供給穴９の高圧容器３ａ，３ｂの内側の下端には、開閉弁である電磁遮断弁１７が設けられている。電磁遮断弁１７は、ソレノイドコイル１８により弁体１９を図２の上下方向に移動させることで供給穴９を開閉するものである。なお、電磁遮断弁１７を設ける場所は、プラグ７の外側や、供給ライン４の途中に設けることもできる。また、電磁遮断弁１７はその他の公知の遮断弁とすることができるが、非稼動時に高圧ガスの供給を停止できるように、いわゆる常閉（ノーマルクローズ）型が望ましい。

【００１６】さらに、開放穴１１は、その外側に安全弁１０が設けられており、安全弁１０には開放用の配管２０が備え付けられている。図３において安全弁１０は、高圧容器３ａ，３ｂの内側に向けて弁体２１をバネ２２で付勢する構成を有しており、バネ２２の他端側は、可溶金属２３が配置されている。ここで、可溶金属２３は他の部材に比べて低い融点を有しているので、高圧容器３ａ，３ｂの温度が高温になった場合は、可溶金属２３が最初に溶ける。従って、可溶金属２３が溶けるのに伴い、弁体２１が高圧ガスに押され、開放用の配管２０から高圧ガスが大気に放出される。従って、温度上昇による高圧容器３ａ，３ｂの内圧が所定値以上の高圧となることを防止できる。

【００１７】次に、高圧ガス供給システム１の充填ライン５および供給ライン４について説明する。図２に示すように、充填ライン５は、図示しない供給源に接続するための接続部２４と、接続部２４に接続された充填配管２５を有し、充填配管２５は、配管分岐部２６において、高圧容器３ａ，３ｂのそれぞれに接続された充填配管２７，２８に分岐している。なお、接続部２４は、充填ライン５に外気等が入ることを防止するための逆止弁２９を有している。また、供給ライン４は、各高圧容器３ａ，３ｂのそれぞれの供給穴９に接続された供給配管３０，３１と、この二つの供給配管３０，３１を合流させる配管合流部３２を有しており、合流した後の供給ライン４は、供給配管３３で図１の燃料電池２に接続されている。なお、合流前の供給配管３０には逆流防止手段である逆止弁３４ａが設けられている。この逆止弁３４ａは高圧容器３ａの内圧が配管合流部３２側の圧力よりも高い場合にのみ高圧ガスが供給配管３０を流れる向きに配置されている。また、同様に、供給配管３１には逆流防止手段である逆止弁３４ｂが設けられている。この逆止弁３４ｂは高圧容器３ｂの内圧が配管合流部３２側の圧力よりも高い場合にのみ高圧ガスが供給配管３１を流れる向きに配置されている。従って、この逆止弁３４ａ，３４ｂにより配管合流部３２から高圧容器３ａ，３ｂの内部に高圧ガスが逆流することを防止できる。

【００１８】次に、この高圧ガス供給システム１を用いて高圧ガスを充填する手順について説明する。高圧容器３ａ，３ｂのどちらか一方もしくは両方の内圧が所定圧力値以下になった場合は、自動車のインストルメントパネル等に警告灯が点灯するので運転者は、高圧ガス供給ステーションで高圧容器３ａ，３ｂに高圧ガスの再充填を行う。この場合は、まず、高圧ガス供給ステーションの供給源と高圧ガス供給システム１の接続部２４とを公知の方法で接続する。そして、供給源側の供給用バルブを開放して、高圧ガス供給システム１の充填ライン５に高圧ガスを導入する。このとき、供給源側の圧力は高圧容器３ａ，３ｂに比べて十分高い（例えば、高圧容器３ａ，３ｂの目標充填圧が２５ＭＰａに対して供給源の元圧が５０ＭＰａ）ので、高圧容器３ａ，３ｂのプラグ７内の逆止弁１３は高圧容器３ａ，３ｂの内側に向けて押される。従って、プラグ７の充填穴８が連通し、充填ライン５から高圧ガスが高圧容器３ａ，３ｂ内にそれぞれ流れ、高圧ガスの再充填が開始される。

【００１９】高圧容器３ａ，３ｂ内の圧力が所定値（例えば、２５ＭＰａ）になると、高圧容器３ａ，３ｂの内圧と供給源側の圧力との差が小さくなるので、逆止弁１３の弁体１４がバネ１５により押し戻されて、充填穴８が弁体１４で閉じられる。そして、供給源と高圧ガス供給システム１の接続を解除すると、高圧容器３ａ，３ｂへの高圧ガスの再充填が終了する。このとき、高圧容器３ａ，３ｂ内の圧力はプラグ７内の逆止弁１３により保たれる。なお、充填作業前の高圧容器３ａ，３ｂのそれぞれの内圧が異なる場合、例えば高圧容器３ａの内圧が１５ＭＰａ、高圧容器３ｂの内圧が１０ＭＰａであっても、それぞれのプラグ７内の逆止弁１３の動作は独立なので、高圧容器３ａおよび高圧容器３ｂのそれぞれの内圧が所定値（例えば２５ＭＰａ）になるまで、高圧ガスが充填される。

【００２０】さらに、このように高圧ガスが充填された高圧容器３ａ，３ｂから燃料電池２に高圧ガスを供給する場合について説明する。高圧容器３ａからのみ高圧ガスを供給する場合は、図示しない制御装置からの信号を受けて、高圧容器３ａの電磁遮断弁１８のみを開状態に

する。すると、供給ライン４の配管合流部３２側の圧力は高圧容器３ａの内圧に比べて十分低いので、供給配管３０の逆止弁３４ａの弁体３５は、高圧容器３から供給された高圧ガスにより押され、図２に示す位置から図３に示す位置まで押し上げられるので、逆止弁３４ａ内に流路が確立される。従って、高圧容器３内の高圧ガスは、図３の矢印に示す方向に流れ、さらに、図２に示す配管合流部３２、供給配管３３を経て、燃料電池２に供給される。このとき、高圧ガスは、配管合流部３２から供給配管３１内にも流れるが、供給配管３１の逆止弁３４ｂは、配管合流部３２側が高圧になっても流路を確立しないので、高圧容器３ａから供給される高圧ガスが高圧容器３ｂに逆流することはない。

【００２１】一方、高圧容器３ｂからのみ高圧ガスを供給する場合についても前記と同様であり、逆止弁３４ａにより高圧容器３ｂから供給される高圧ガスが高圧容器３ａに逆流することを防止できる。これは、常に内圧の高いほうの高圧容器３ａ，３ｂの逆止弁３４ａ，３４ｂが開状態になり、内圧の低いほうの高圧容器３ａ，３ｂの逆止弁３４ａ，３４ｂが閉状態になることを意味するので、両方の高圧容器３ａ，３ｂのそれぞれの電磁遮断弁１７を同時に開放しても、どちらか一方の高圧容器３ａ，３ｂに他方の高圧容器３ａ，３ｂからの高圧ガスが逆流することはない。また、高圧容器３ａおよび高圧容器３ｂの内圧が同程度の場合は、両方の逆止弁３４ａ，３４ｂが同時に開状態になることがあるが、この場合は内圧が同程度であるため高圧ガスの逆流はほとんど起きないので問題は生じない。

【００２２】このような高圧ガス供給システム１を用いると、高圧ガスの充填時もしくは供給時に、二つの高圧容器３ａ，３ｂの間に圧力差があっても、内圧の高い高圧容器３ａ，３ｂから供給ライン４を介して、内圧の低い高圧容器３ａ，３ｂに高圧ガスが逆流することを防止することができる。従って、高圧ガスの急激な逆流による発熱現象で高圧容器３が高温になることを防止できる。なお、図２および図３において逆止弁３４ａ，３４ｂは、それぞれ供給配管３０，３１中に設けたが、高圧容器３ａ，３ｂのそれぞれのプラグ７に埋め込むことも可能である。

【００２３】次に、本発明の高圧ガス供給システムの別の実施の形態を図４を用いて説明する。なお、図２と同一の構成要素については同一の符号を付して、その説明を省略する。図４に示すように、高圧ガス供給システム４１は、二つの高圧容器３ａ，３ｂと、高圧容器３ａ，３ｂのそれぞれに高圧ガスを充填するための充填ライン５と、高圧容器３ａ，３ｂのそれぞれから高圧ガスを燃料電池２に供給するための供給ライン４とを有している。また、前記の実施例と同様に高圧ガス供給システム４１は、高圧ガスの圧力をモニターするための図示しない圧力計が設けられている。

【００２４】ここで、供給ライン４は、各高圧容器３ａ，３ｂの供給穴９に接続された二つの供給配管３０，３１と、燃料電池２に高圧ガスを供給する供給配管３２とを有しており、供給配管３０，３１，３２の配管合流部には、供給配管３０，３１のどちらか一方を供給配管３３に連通させるための三方弁４２を備えている。ここで、三方弁４２は、供給配管３０が接続されたポート４２ａと、供給配管３１が接続されたポート４２ｂ、ならびに、供給配管３３が接続されたポート４３を有し、アクチュエータ４４で弁体を移動させることで、ポート４２ａ（供給配管３０）とポート４３（供給配管３３）の接続と、ポート４２ｂ（供給配管３１）とポート４３（供給配管３３）との接続を選択して確立することができる構造を有するものである。

【００２５】このような高圧ガス供給システム４１は、三方弁４２の切り替えにより、どちらか一方の高圧容器３ａ，３ｂのみが燃料電池２に高圧ガスを供給する構成となる。従って、三方弁４２の切り替えにより供給配管３０と供給配管３３とを接続した場合は、供給配管３１はこれらの供給配管３０，３３から切り離されることになるので、供給配管３１に高圧ガスが流れることはないから、高圧ガスの逆流は起こらない。同様に、三方弁４２の切り替えにより供給配管３１と供給配管３３を接続した場合は、供給配管３０はこれらの供給配管３１，３３から切り離されることになるので、供給配管３０に高圧ガスが流れることはないから、高圧ガスの逆流は起こらない。従って、ここにおいて、三方弁４２は、特許請求の範囲に記載の逆流防止手段を構成する。

【００２６】なお、本発明は前記の各実施の形態に限定されずに広く応用することができる。例えば、逆流防止手段は、図２に示す供給配管３０，３１のそれぞれに設けられた逆止弁３４ａ，３４ｂと、図３に示す三方弁４２とで構成しても良い。また、逆流防止手段は、図２の配管合流部３２と供給配管３０との間、および配管合流部３２と３１の間のそれぞれに電磁遮断弁を設け、この電磁遮断弁の開閉を切り替えることで高圧ガスを供給する高圧容器３ａ，３ｂを選択する構成としても良い。さらに、高圧ガス供給システム４１において、複数の三方弁４２を直列や、並列に組み合わせることで、３本以上の高圧容器３ａを備えた高圧ガス供給システムにも対応することができる。そして、高圧ガス供給システム１，４１は、燃料電池２に供給する高圧ガスの圧力を調整するための減圧弁を備えることが望ましい。減圧弁は、供給配管３３に設けることが好ましいが、各高圧容器３ａ，３ｂごとに設けても良い。

【００２７】

【発明の効果】本発明は、複数の高圧容器のそれぞれから高圧ガスを供給可能な構成を有する高圧ガス供給システムにおいて、供給ラインに高圧ガスの逆流を防止する逆流防止手段を設けて、各高圧容器から供給される高圧

ガスが特定の方向にのみ流れる構成としたので、複数の高圧容器のそれぞれに収容されている高圧ガスの間に圧力差があっても、圧力の高い高圧ガスが、内圧の低い高圧容器に逆流することを確実に防止できる。従って、高圧ガスの供給時に、内圧の低い高圧容器に水素ガスを主とする高圧ガスが逆流することで、高圧ガスおよび高圧容器の温度が急上昇することを防止できる。特に、逆流防止手段を配管合流部と高圧容器の間に設けられた逆止弁とすると、供給ラインを逆流しようとする高圧ガスの流れを確実にストップさせることができる。また、逆流防止手段は、配管合流部に設けられた三方弁とすると高圧ガスが流れるラインと、そのラインから切り離されたラインを選択することが可能となるので、選択されなかった方のラインに高圧ガスが逆流することを防止できる。

【図面の簡単な説明】

【図１】本発明の実施の形態の高圧ガス供給システムが搭載される燃料電池電気自動車を示す概略図である。

【図２】本発明の実施に形態の高圧ガス供給システムの構成図である。

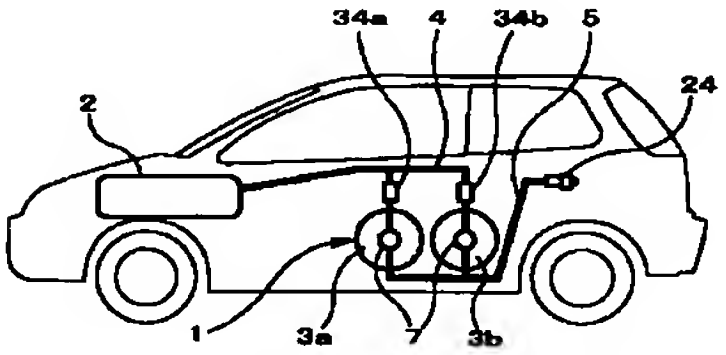
＊【図３】高圧容器のプラグの構成を示す拡大図である。

【図４】本発明の別の実施の形態を示す高圧ガス供給システムの構成図である。

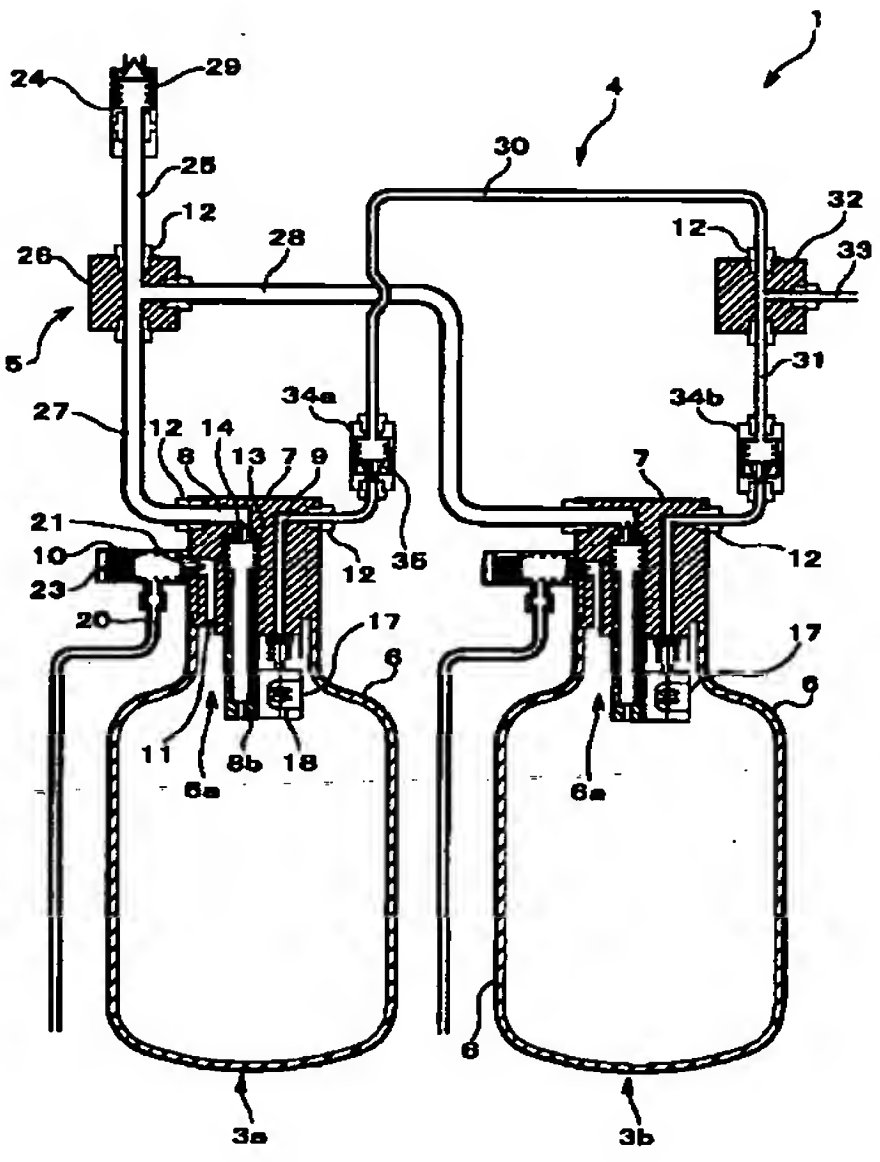
【符号の説明】

１	高圧ガス供給システム
２	燃料電池
３ａ，３ｂ	高圧容器
４	供給ライン
５	充填ライン
７	プラグ
８	充填穴
９	供給穴
１０	安全弁
１１	開放穴
１３，２９	逆止弁
１７	電磁遮断弁　（開閉弁）
３０，３１，３３	供給配管
３２	配管合流部
３４ａ，３４ｂ	逆止弁　（逆流防止手段）
４２	三方弁　（逆流防止手段）

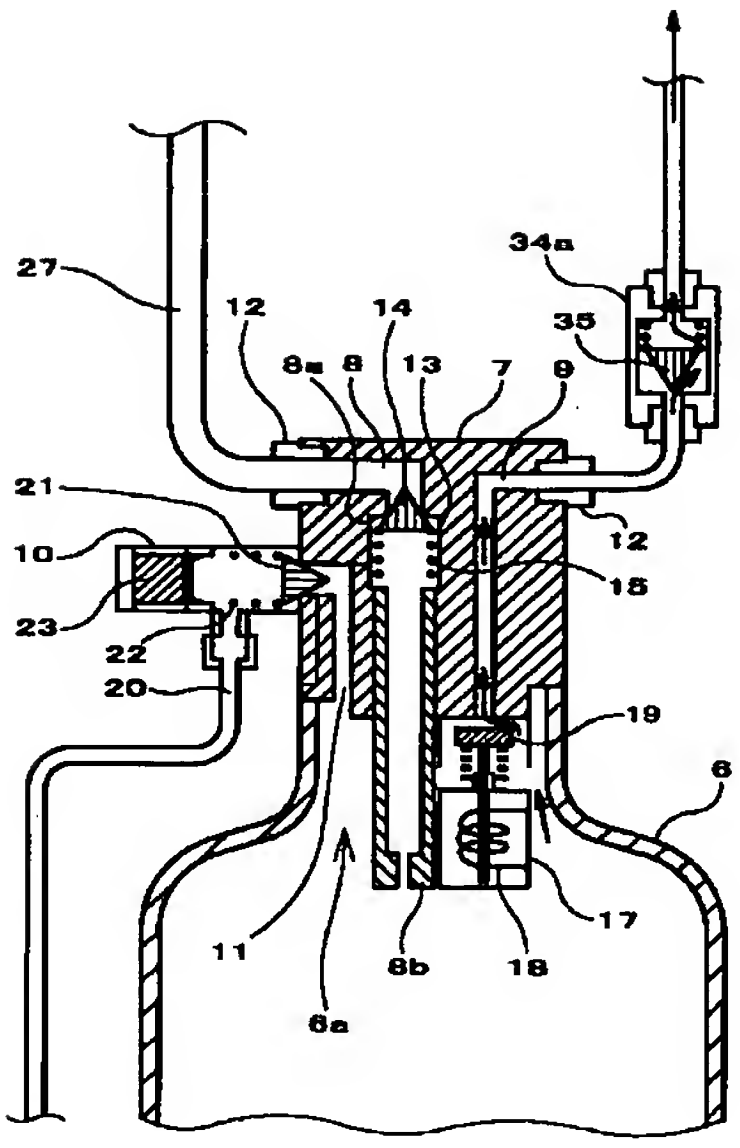
【図１】



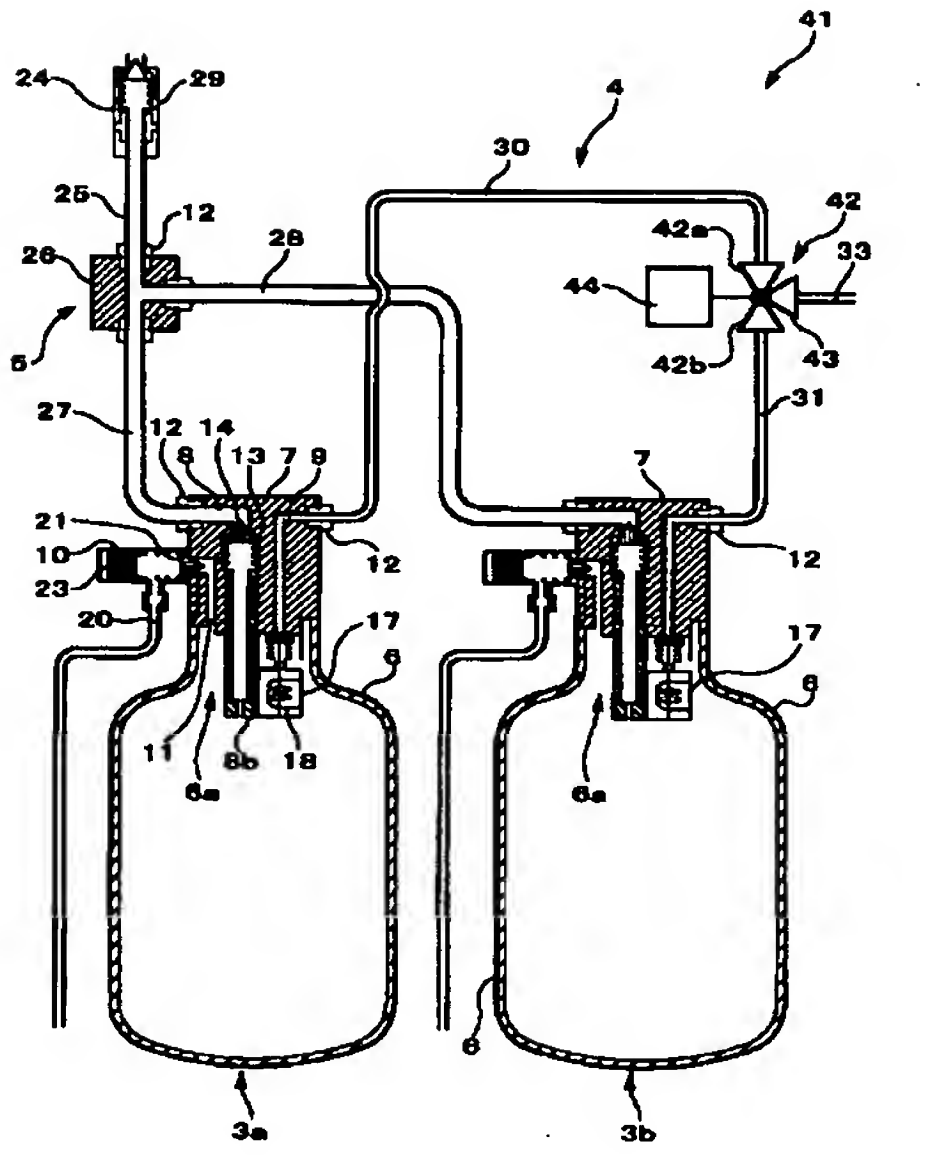
【図２】



【図３】



【図４】



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